INCH-POUND

MIL-DTL-52649C
11 May 2009
SUPERSEDING
MIL-E-52649B
18 November 1992

DETAIL SPECIFICATION

ENGINE COLD STARTING AIDS, ETHER FUEL PRIMERS

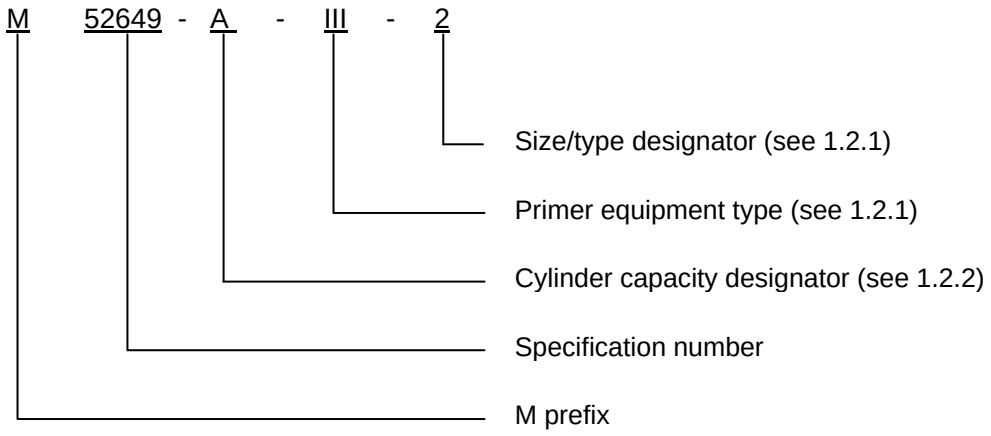
MIL-E-52649B, dated 18 November 1992, is hereby reactivated and may be used for either new or existing design acquisition.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers primer equipment for adding controlled quantities of engine priming fuel to internal combustion engines of commercial equipment as an aid in starting at low temperatures.

1.2 Part or Identifying Number (PIN). The PIN to be used for engine cold starting aids acquired to this specification are created as follows:



Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, Attn: DSCC-VAI, P.O. Box 3990, Columbus OH 43218-3990, or emailed to FluidFlow@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

1.2.1 Classification. The primer equipment will be classified as one of the following types and sizes:

Size designator	Description
2	2.5 cubic centimeters (cc) discharge, see 3.5.1.
4	4 cc discharge, see 3.5.2.
5	5 cc discharge, see 3.5.3.
6	6 cc discharge, see 3.5.4.
12	12 cc discharge, see 3.5.5.

Type designator	Description
III	Gas propellant primer equipment system, 18 ounce (oz) cylinder. Use with capacity designator A only, see 1.2.2 and 3.5.6.
V	Gas propellant fully automatic primer equipment system, 18 oz or 21 oz cylinder. Use with capacity designator A or B, see 1.2.2 and 3.5.7.

1.2.2 Capacity designator. The capacity designator is a letter code used to designate the required cylinder capacity as follows:

Capacity designator	Cylinder capacity
A	18 oz
B	21 oz

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort had been made to ensure the completeness of the list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not the are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATION

O-F-1044 - Fuel, Engine Primer: Cold Starting, in Pressurized and Non-pressurized Containers.

FEDERAL STANDARD

FED-STD-H28 - Screw-Thread Standards for Federal Services

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-E-199	-	Ether, Diethyl, Technical
MS39254	-	Cylinder, Engine Starting (Engine Cold-Starting Aid)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	-	Identification Markings of U.S. Military Property
MIL-STD-889	-	Dissimilar Metals

(Copies of these documents are available online at http://assist.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

ASTM INTERNATIONAL

ASTM B633	-	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D2000	-	Standard Classification System for Runner Products in Automotive Application

(Copies of these documents are available online at http://www.astm.org or from the ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. Unless otherwise noted here in or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.5

3.2 Description. The primer equipment shall consist of a permanently mounted frame accepting one of the engine primer fuel containers utilizing bulk primer fuel as specified in O-F-1044, a control device for metering the discharge through safety accessories, a discharge tube, and intake manifold dispensing nozzles.

3.3 Dissimilar metals. Dissimilar metal shall not be used in intimate contact with each other unless protected against galvanic corrosion. Dissimilar metals and methods of protection as specified in MIL-STD-889.

3.4 Materials. Materials shall be as specified herein. Materials not specified shall be selected by the contractor, and shall be subject to all provisions of this specification. Mounting frames and metering devices shall be made from corrosion-resistant metals, nylon, or steel, zinc-coated in accordance with ASTM B633, Fe/Zn 25 SC 4, type VI. The remote control cables, when applicable, shall be of austenitic stainless steel or lubricated and encased in plastic sleeves.

3.4.1 Material deterioration prevention and control. The primer equipment shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide protection against the various forms of corrosion and deterioration that may be encountered in any of the applicable operating and storage environments to which the primer equipment may be exposed.

3.4.2 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with component and subcomponent, and shall make information available upon request to the contracting officer or designated representative.

3.4.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials shall be used to the maximum extent possible provided that the material meets operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.5 Design and construction.

3.5.1 Size 2. Size 2 primer shall deliver 2.5 ± 0.5 cc of primer fuel at the atomizer during on operation cycle.

3.5.2 Size 4. Size 4 primer shall deliver 4 ± 0.5 cc of primer fuel at the atomizer during one operation cycle.

3.5.3 Size 5. Size 5 primer shall deliver 5 ± 0.5 cc of primer fuel at the atomizer during one operation cycle.

3.5.4 Size 6. Size 6 primer shall deliver 6 ± 0.5 cc of primer fuel at the atomizer during one operation cycle.

3.5.5 Size 12 . Size 12 primer shall deliver 12 ± 1.0 cc of primer fuel at the atomizer during one operation cycle.

3.5.6 Type III gas propellant priming equipment. Type III primer equipment shall be as follows:

a. Utilize an 18 ounce cylinder in accordance with MS39254 charged with engine primer fuel with propellant as specified in O-F-1044, type III.
b. The primer equipment shall be attached to the primer container by screw threads in accordance with FED-STD-H28 and a rubber gasket in accordance with ASTM D2000 class M3BG614C12EO34F19, shall be provided for a leak-free connection.
c. The primer equipment mounting shall fix and support the fuel container vertically and shall prohibit movement horizontally. The mount shall hold the container by friction, over-center type, or screw-type clamping device.
d. The clamping device shall permit changing of the fuel container by an operator wearing arctic-mittens.
e. Control shall be by mechanical or electro-mechanical linkage. The metering device shall be double acting.

f. The primary action shall open the chamber in the volume specified by the applicable size.
g. The secondary action of the metering valve shall allow the container valve to close to prevent continued flow, and at the same time, the chamber outlet valve open, allowing the accumulated gas to propel the charge of primer fuel through flexible copper or nylon tubing to the atomizer.

3.5.6.1 Type III safety accessories. When specified (see 6.2), thermal controls to protect an engine against ether injection after warm-up, and cranking controls to protect against hydraulic block by excessive ether injection prior to cranking shall be furnished.

3.5.6.1.1 Temperature and pressure control combination. When applicable, safety controls shall be furnished separately or in combination. For combination use, utilizing the pressure-sensitive valve (see 3.5.3.2), the thermal valve (see 3.5.3.3) shall be placed in the primer line between the metering device and the oil-pressure sensor plug. This combination will inhibit injection of primer fuel when the oil pressure of the engine is below 3 psi and when the block temperature of the engine rises above 50 °F (10 °C).

3.5.6.1.2 Cranking control. The cranking control shall be a pressure-sensitive valve. The valve shall be normally closed, inhibiting the flow of primer fuel between the metering equipment and the air induction system. The valve shall open at an oil pressure of 5 psi (34.5 kPa) and above, and will close when oil pressure falls below 3 psi (20.7 kPa). The control design shall be such that primer fuel can only be injected into the manifold when oil pressure due to cranking reaches 5 psi and above. The pressure sensor shall have 1/8-inch pipe threads in accordance with FED-STD-H28.

3.5.6.1.3 Temperature control. When a thermal control is specified, either of the following types may be furnished.

3.5.6.1.4 Engine coolant temperature control. The temperature control device shall receive thermal energy from the cooling system. The device shall prevent the flow of ether when the coolant temperature rises above the 100 °F (37.7 °C). Upon cooling, the device shall open to allow ether flow at 50 °F (10 °C) or below engine coolant temperature.

3.5.6.1.5 Engine manifold temperature control. The temperature control device shall receive thermal energy from the exhaust manifold. The device shall prevent the flow of ether when the exhaust manifold temperature rises above the 140 °F (60 °C). Upon cooling, the device shall open to allow ether flow at 50 °F (10 °C) or below exhaust manifold temperature.

3.5.7 Type V gas propellant fully automatic priming equipment. Type V primer equipment shall be as follows:

a. Utilize an 18-ounce (.51 kg) or 21-ounce (.60 kg) cylinder, in accordance with MS39254, charged with engine primer fuel with propellant as specified in O-F-1044, type III.
b. The primer equipment shall be attached to the primer container by screw threads in accordance with FED-STD-H28 and a rubber gasket conforming to ASTM D2000 class M3BG614C12EO34F19, shall be provided for a leak-free connection.
c. The primer equipment mounting shall fix and support the fuel container vertically and shall prohibit movement horizontally. The mount shall hold the container by friction, over-center type, or screw-type clamping device.
d. The clamping device shall permit changing of the fuel container by an operator wearing arctic-mittens.
e. The primer equipment engine temperature sensor switch shall determine when the system shall function.
f. When needed, the solenoid valve shall be activated automatically during engine cranking, then the primer fuel shall be released from the pressurized cylinder, flows through the valve, through the metering orifice at full cylinder pressure, through flexible copper or nylon tubing and, out of an injector nozzle located in the engine's air intake system.
g. The valve shall have a reservoir that maintains flow of primer fuel after cranking to prevent the just-started engine from faltering or dying.
h. The primer equipment shall deliver not more than 0.25-cc of primer fuel per 100 cubic inches of engine displacement per second.
i. The primer fuel flow shall be continuous throughout the cranking operation.

3.5.7.1 Type V safety accessory. The type V primer equipment shall be with a factory-preset interlock engine temperature sensor which shall prevent the primer equipment from supplying primer fuel to a warm engine.

3.6 Performance.

3.6.1 Diethyl ether stability. When tested in accordance with 4.7.2, non-metallic material shall not swell, harden or soften rendering the non-metallic parts unfit for the endurance test (see 4.7.3).

3.6.2 Endurance. When tested in accordance with 4.7.3, the plastics, rubbers, and fibers utilized in the fabrication of primer equipment shall remain functional.

3.6.3 Thermal stability and discharge volume. When tested in accordance with 4.7.4 the primer equipment shall operate to discharge a repeatable volume of fuel within 0.5 cc of the specified volume, without leakage, in temperatures ranging from -65 to +100 °F for 1,000 cycles.

3.6.4 Valve actuation. The solenoid-actuated valve shall activate when voltage is applied to it.

3.6.5 Leakage. No leakage shall be observed coming from the primer after the activation of the valve.

3.7 Treatment and painting. Unless otherwise specified (see 6.2), the painting of the primer equipment shall be the supplier's standard. When specified (see 6.2), painting shall be in accordance with the acquisition requirements.

3.8 Identification markings. Identification markings shall be in accordance with MIL-STD-130, method optional, and shall include as a minimum the following:

a. The capacity of the metered primer fuel output as specified by the given size.
b. Contractor's name and model as applicable.

3.9 Workmanship. Components and assemblies of the primer equipment including seals, stampings, and moldings shall be clean and free from fins, sharp edges, pits, or scratches. Each primer assembly shall be complete and function smoothly and to its specified capacity. Each primer shall be examined for the following defects as specified in table I.

TABLE I. Workmanship defects.

Examination	Requirement Paragraph
Materials not as specified	3.4
Materials not resistant to corrosion and deterioration, or treated to be resistant to corrosion or deterioration of the applicable operating and storage environments	3.4.1
Dissimilar metals as defined in MIL-STD-889 are not effectively insulated from each other	3.3
Contractor does not have documentation available for identification of materials, material finishes, or treatment	3.4.2
Used, rebuilt, or remanufactured components, pieces, and parts incorporated in the primer equipment	3.4.3
Type and size of primer equipment not as specified	3.5.1 through 3.5.7
Safety accessories not as specified	3.5.6.1 and 3.5.7.1
Treatment and painting not as specified	3.7
Identification markings not as specified	3.8

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.5).

b. Conformance inspection (see 4.6).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the applicable test method (see 4.7).

4.3 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be used.

4.4 Responsibility for compliance. All items shall meet all requirements of sections 3, 4, and 5. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.5 First article inspection. First article inspection shall be performed at a laboratory acceptable to the procuring activity on sample units produced with equipment and procedures used in production.

4.5.1 Samples for first article. One primer unit for first article shall be representative of the products proposed to be furnished to this specification

4.5.2 First article inspection routine. One primer unit shall be subjected to first article testing in table II. The test sequence shall be determined by the manufacturer unless otherwise specified.

TABLE II. First article inspection.

Inspection	Requirement	Test method
Examination	3.8 and 3.9	4.7.1
Diethyl ether stability	3.6.1	4.7.2
Endurance	3.6.2	4.7.3
Thermal stability and discharge volume	3.6.3	4.7.4

4.5.3 Failures. All samples shall meet all of the contract requirements. Failure of a sample unit to pass any test shall be cause for rejection of the entire lot and to grant first article approval.

4.5.4 First article information. Upon completion of first article inspection, the Government activity responsible for conducting the inspection program (see 6.5), shall report the results of the inspection, with appropriate recommendation, to the contracting officer. Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing individual, or sampling and periodic inspections.

4.5.4.1 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2).

4.6. Conformance inspection. For manufacturers that have successfully passed first article inspections and are continuously producing primer units to this specification, ongoing inspections shall consist of individual inspections (see table III). If first article is waived due to prior successful first article inspection, the individual inspection shall be the manufacturer's in house inspection procedures.

4.6.1. Individual inspection. Individual inspection shall consist of the inspections specified in table III. Individual inspections shall be implemented on a continual basis throughout the production of primer units. Individual inspection tests specified in table III shall be performed on a production lot basis.

TABLE III. Individual inspections.

Inspections	Requirement paragraph	Inspection paragraph	Number of samples
Examination of product	3.8 and 3.9	4.7.1	All
Valve actuation	3.6.4	4.7.5	1
Leakage	3.6.5	4.7.6	1

4.6.2. Nonconformance individual inspections. If one or more defects are found in the inspection lot, then the production lot shall be screened for that particular defect and defects removed. An inspection lot shall be selected from the production lot and all individual tests (see table III) shall be performed. If one or more defects are found in the second inspection lot, the production lot shall be rejected and shall not be supplied to this specification. Test data of part performance shall be made available to the contracting agency upon request.

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4.7 Inspection methods.

4.7.1 Examination of products. The primer equipment shall be examined for identification markings and workmanship as specified in 3.8 and 3.9.

4.7.2 Diethyl ether stability. Gaskets, O-rings moldings, and all non-metallic materials utilized in any sample primer equipment shall meet the requirements of 3.6.1. The testing shall be as follows:

a. Place nonmetallic parts of a sample in a 400 milliliter glass beaker and immerse with diethyl ether conforming to MIL-E-199. Cover with a watchglass and place in a vent space maintained at 73°F ± 2.5 °F (-28°C ± 1.5°C) for 14 days.
b. Remove parts from ether and allow to air-dry for 1 hour.
c. Reassemble the primer equipment sample and proceed with the endurance test.
d. Any swelling, hardening, or softening rendering the nonmetallic part as unfit for endurance test (see 4.7.3), shall constitute a failure of this test.

4.7.3 Endurance. Cold soak the primer equipment at a temperature of not higher than -65°F (-54°C) for a minimum of 4 hours. Using primer fuel conforming to O-F-1044, subject the cold soaked primer equipment to 1,000 cycles of simulated use at an ambient temperature not higher than -65 °F (-54°C). Nonconformance to 3.6.2, binding of components, breakage, or inability to complete the test shall constitute failure of this test.

4.7.4 Thermal stability and discharge volume. Establish the discharge volume for the type and size of primer equipment to be tested as follows:

a. Weigh cylinder and complete primer device.
b. Discharge 10 shots (pausing 6 seconds after pulling lever to allow chamber to fill and 6 seconds to allow it to empty).
c. Reweigh cylinder and primer device. The difference in weight is the total discharge of primer (or primer and propellant) as appropriate.

d. Taking the average weight of the 10 shots, convert to primer volume as follows:

$$\text{Primer Volume} = \frac{\text{(Average shot weight) (91.3\%)}}{\text{Specific gravity ether at discharge temperature}}$$

Average shot weight = From (c) above.
91.3% = Empirically arrived at percent of ether in total discharge.
Specific gravity of ether = Supplied from data published by ether supplier.

4.7.5 Valve actuation. Activation shall be determined by visual confirmation of fuel discharge from the nozzle of the primer equipment.

4.7.6 Leakage. Leakage shall be determined through a visual inspection of the unit after the successful actuation of the solenoid-valve.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order see (6.2). When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the Military Service's System Commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The primer equipment is intended as permanent installation for cold starting internal combustion engines, utilizing ether engine primer fuel in accordance with O-F-1044.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. PIN (see 1.2).

c. Quantity required.

d. Whether first article inspection is waived (see 4.5).

e. Lot records if required (see 4.5.4).

f. Name and address of the first article inspection test facility to which first article samples if required (see 4.5) are to be forwarded and the name and address of the Government activity responsible for conducting the first article inspection program (see 4.5.4 and 6.5).

g. Packaging requirements (see 5.1).

h. Whether identification of materials and finishes are required (see 3.4.2).

6.3 Technical manuals. The requirement for technical manuals for such data as technical publications, instructional materials, and supplier's maintenance and operational manual should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DoD 5010. 12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website at http://www.epa.gov/osw/hazard/wastemin/priority.htm. Included in the list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.5 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first article samples. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.6 Subject term (key word) listing.

Atomizer
Metering
Mounted
Solenoid valve

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army – AT
Air Force – 99
DLA – CC

Review activity:
Air Force – 70

Preparing activity:
DLA - CC

(Project 2910-2009-002)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.